

Influence of Visual, Auditory, Kinesthetic Learning Style on the Ability of Troubleshooting E-Learning-Based Math

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Abstract

This study aims to: Know the effect of VAK learning styles on students' mathematical problem solving abilities, Know the contribution of each learning style to students' mathematical problem solving abilities, Know the effect of VAK learning styles on e-learning, and Know the contribution of each learning style to e-learning. This type of research is a quasi experiment. The population in this study were all grade VII students of SMP Negeri 1 Binjai and the sample in this study were 3 classes of 96 students. The results showed that there was influence VAK learning style on students' mathematical problem solving abilities of $F_{count} = 2.746$ greater than $Table = 2.70$; and there are contributions significant from each of them VAK learning style on students' mathematical problem solving abilities in SMP Negeri 1 Binjai that is overall by 8.2%, visual learning styles by 8.1%, auditory learning styles by 0.9%, and kinesthetic learning styles by 2.1%. Next there is influence VAK learning style towards e-learning learning of $F_{count} = 2.783$ greater than $Table = 2.70$; and there are contributions significant from each of them VAK learning style towards e-learning learning in SMP Negeri 1 Binjai that is overall by 8.3%, visual learning styles by 6.4%, auditory learning styles by 1.2%, and kinesthetic learning styles by 5.2%. Thus it can be concluded that there is an influence of VAK learning style on students' mathematical problem solving abilities based on e-learning in SMP Negeri 1 Binjai.

Keywords: VAK learning styles, students' mathematical problem solving abilities, e-learning learning

DOI: 10.7176/JEP/11-18-20

Publication date: June 30th 2020

1. PRELIMINARY

Education is a process of educating, which is a process in order to influence students to be able to adapt themselves as best as possible to their environment, so that it will cause changes in themselves. Thus, education is a priority factor that needs to be built and improved in quality (Sutikno, 2006).

Mathematics is very important to be taught to all students because its contribution is very broad and useful in all aspects of human life. But in reality, many people view mathematics as the most difficult field of study, from elementary school to tertiary level. As revealed by Abdurrahman (2012) that from various fields of study taught at school, mathematics is a field of study that is considered the most difficult by students, both those who have no learning difficulties and more so for students who have learning difficulties.

One aspect emphasized in the curriculum is improving students' problem solving abilities. Problem solving is part of a very important mathematics curriculum because in the learning process and its completion, students are allowed to gain experience using knowledge and skills that are already possessed to be applied to solving problems that are not routine. Cooney (Hudojo, 2015) said that teaching students to solve problems enables students to be more analytical in making decisions in life. But it is considered the most difficult part in learning it and for teachers in doing it. A problem usually contains a situation that encourages someone to solve it.

According to Amir (2013) states that each individual has differences between one another. These differences vary, ranging from physical differences, patterns of thinking and ways to respond or learn new things. In terms of learning, each individual has advantages and disadvantages in absorbing the lessons given. Therefore in the world of education various methods are known to be able to meet the demands of individual differences.

This is in accordance with the opinion of DePorter & Hernacki (2016) that "The problem may be a mismatch between the student's learning style and the teacher's learning style". DePorter & Reardon (2014) further explained that teachers tend to teach with their learning styles. However, not all students have the same learning style as the teacher. There are students who like the teacher teaching by writing everything on the board. There are also students who prefer the teacher to teach by delivering material orally, and there are those who directly describe the contents of the teacher's lectures in a form that they understand themselves. Student differences in managing the information above are influenced by learning styles. So students experience a mismatch between the learning styles of the teacher and the learning styles they have.

Based on the ability of the brain to absorb, manage and convey information, individual learning styles can be divided into 3 categories. The three categories are visual, auditory and kinesthetic learning styles which are characterized by certain behavioral traits. This categorization does not mean that each individual only has one characteristic of a particular learning style so that it does not have the characteristics of another learning style. This categorization is only a guideline that each individual has one of the most prominent characteristics so that

if he gets an appropriate stimulus in learning it will make it easier to absorb the lesson. In other words, if the individual finds a learning method that is suitable with the characteristics of the way he learns, then he will quickly become "

This is also supported by the results of an interview with one of the mathematics studies teachers at SMP Negeri 1 Binjai saying that "Generally students have difficulty in learning mathematics when the questions given are not the same as the examples. If the problem varies or is different from the example given, students will find it difficult to work on the problem. Students are also less able to solve problems in the form of stories. Teachers generally deliver material using lecture and discussion methods without regard to the learning style trends of each student. Therefore, at the beginning of the learning experience, one of the steps of the teacher is to recognize one's learning style, namely visual, auditory, and kinesthetic learning styles.

The purpose of writing this article is to determine the effect between VAK learning styles (Visual, auditory, kinesthetic) towards students' mathematical problem solving abilities based on e-learning.

2. RESEARCH METHODS

This type of research used in this study is a quasi experimental method, namely research that aims to determine the effect of VAK learning styles (Visual, Auditory, Kinesthetic) on the ability to solve mathematical problem solving based on e-learning.

This study involved three sample classes that applied VAK learning styles with one variable linear equation material. To measure the ability to solve mathematical problems obtained from the application of these treatments, students are given a final test. The research design used in this study is the Posttest Control Group Design. Posttest is used to measure the ability to solve mathematical problems after treatment. The research design carried out in this experimental study is presented as follows.

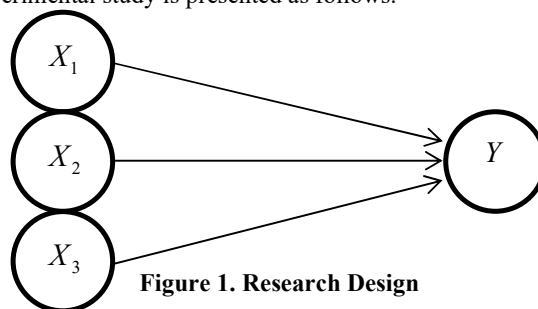


Figure 1. Research Design

Information :

X_1 = Visual learning style

X_2 = Auditory learning style

X_3 = Kinesthetic learning style

Y = The ability to solve mathematical problems based on e-learning.

Research Instruments

Learning Style Questionnaire

To determine the learning style students have using a questionnaire. The questionnaire is a closed questionnaire in the Likert scale model. How to use a questionnaire is to give some statements to the questionnaire that already represents the three learning styles and students choose according to their personality.

Mathematical Problem Solving Ability Test

This test is conducted to determine the improvement of students' mathematical problem solving abilities. This test was arranged in the form of a description consisting of 4 questions. The scoring in measuring understanding uses a free scale, depending on the weight of the item. As said by Arikunto (2012) that in determining the highest score of the free description test using a non-fixed scale, the highest number used is not always the same. So scoring depends on the difficulty of the questions on the problem.

To determine the level of problem solving ability of students obtained from the test of students' problem solving abilities by looking at the results of student tests formed with a range of grades (0-100). In conducting an assessment of a problem solving ability test, generally it follows the assessment rules presented by Purwanto (2009), as follows.

$$\text{score} = \frac{\text{score value obtained}}{\text{score maximum}} \times 100$$

To determine the category of students' problem solving abilities, the average problem solving ability of

students is converted to a qualitative form by paying attention to the assessment guidelines according to Arikunto (2012). After the value of students' problem solving abilities is converted into qualitative form, it is obtained an overview of the level of students' problem solving abilities in learning mathematics.

Data Analysis Technique

Significance Test (Significance) Regression Equation

1. Determine the significance test
The steps to test the significance of using SPSS are as follows. (Riadi, 2016)
 - a. Click the Analyze → Regression → Linear menu.
 - b. Fill the Dependent box with variables Y and Independent boxes with variables X_1, X_2, X_3 , then click ok (the results will appear from the output data).
2. Make decision
 - If the Sig. ≤ 0.05 then it is rejected, meaning the coefficient of regression equation is significant H_0
 - If the Sig. > 0.05 , it is accepted, meaning that the regression equation coefficient is not significant H_0

Linearity Regression Test

1. Determine the significance test
The steps to test the significance of using SPSS are as follows. (Riadi, 2016)
 - a. Click the Analyze menu → Compare Means → Means.
 - b. Fill the Dependent List box with variables Y and the Independent List box with variables X_1, X_2, X_3 , then clicking Options.
 - c. Choose Test for linearity, then click Continue and click ok (the results will appear from the output data).
2. Make decision
 - If the Sig. ≤ 0.05 then it is rejected, meaning that the regression line is not linear H_0
 - If the Sig. > 0.05 , it is accepted, meaning linear regression line H_0

Estimation Model Multiple Linear Regression Test

Before a linear regression calculation is performed, there are several steps that must be performed according to Siregar (2014: 443), namely as follows.

1. Determine the statistical model
The multiple linear regression statistical model of this study is as follows.

$$\hat{Y} = b_0 + b_1X_1 + b_2X_2 + b_3X_3$$

Information :

\hat{Y} : ability solution to problem mathematical student e-based learning

X_1 : Visual learning style

X_2 : Auditory learning style

X_3 : Kinesthetic learning style

b_0 : bound variable value

b_1 : regression coefficient between independent variables X_1 with respect to the dependent variable

b_2 : regression coefficient between independent variables X_2 with respect to the dependent variable

b_3 : regression coefficient between independent variables X_3 with respect to the dependent variable

2. Determine the real level

At this stage will determine how much the opportunity to make the risk of error in making decisions reject the correct hypothesis. The real level or often called the significant level is symbolized by α . In the education sector the significance level used is 5% ($\alpha = 0,05$).

3. Testing rules

- Determine F_{hitung}

$$F_{hitung} = \frac{R^2(n-m-1)}{m(1-R^2)}$$

Where :

$$R = \sqrt{\frac{b_1 \sum x_1 y + b_2 \sum x_2 y + b_3 \sum x_3 y}{\sum y^2}}$$

- Determine F_{tabel}

df numerator (horizontal) = m

df denominator (vertical) = $n - m - 1$

Information :

m : many free variables

n : a lot of data / students

4. Make decision

- If it is accepted, it means that there is no influence $F_{hitung} \leq F_{tabel} H_0$ VAK learning style (Visual, auditory, kinesthetic) towards ability solution to problem mathematical student based e-learning
- If it is rejected, it means that there is influence $F_{hitung} > F_{tabel} H_0$ VAK learning style (Visual, auditory, kinesthetic) towards ability solution to problem mathematical student based e-learning

3. RESULTS AND DISCUSSION

Significance Test (Significance) Regression Equation

Table 1. Test Results The Significance of Regression Equations Against Student Mathematical Problem Solving Ability Test Correlations

Control Variables			Visual	Auditory	Kinesthetic	TKPM
-none-a	Visual	Correlation	1,000	,353	,426	,285
		Significance (2-tailed)	.	,000	,000	,005
		Df	0	94	94	94
	Auditory	Correlation	,353	1,000	,557	,096
		Significance (2-tailed)	,000	.	,000	,351
		Df	94	0	94	94
	Kinesthetic	Correlation	,426	,557	1,000	,143
		Significance (2-tailed)	,000	,000	.	,166
		Df	94	94	0	94
TKPM	Correlation	,285	,096	,143	1,000	
	Significance (2-tailed)	,005	,351	,166	.	
	Df	94	94	94	0	

Based on the results of the SPSS output in Table 1. shows that the test results of the significance of the visual learning style with the test of students' mathematical problem solving abilities obtained Sig. in the amount of 0.005. Because the value of Sig. smaller than 0.05 ($0.005 < 0.05$), then H_0 is rejected. So it can be concluded that the coefficient of the regression equation of visual learning style on students' mathematical problem solving ability test is significant. Furthermore, the significance test results between the auditory learning style and the students' mathematical problem-solving ability tests obtained Sig. amounted to 0.351. Because the value of Sig. greater than 0.05 ($0.351 > 0.05$), then H_0 is accepted. So it can be concluded that the coefficient of the auditory learning style regression equation on the students' mathematical problem solving ability test is not significant. Then the significance test results between kinesthetic learning styles with students' mathematical problem solving ability tests obtained Sig. amounted to 0.166. Because the value of Sig. greater than 0.05 ($0.166 > 0.05$), then H_0 is accepted. So it can be concluded that the coefficient of the kinesthetic learning style regression equation on students' mathematical problem solving ability tests is not significant. Thus, it can be concluded that the coefficient of the regression equation between VAK learning styles and students' mathematical problem

solving ability tests is not significant in auditory and kinesthetic learning styles, but significant in visual learning styles. So it can be concluded that the coefficient of the kinesthetic learning style regression equation on students' mathematical problem solving ability tests is not significant. Thus, it can be concluded that the coefficient of the regression equation between VAK learning styles and students' mathematical problem solving ability tests is not significant in auditory and kinesthetic learning styles, but significant in visual learning styles. So it can be concluded that the coefficient of the kinesthetic learning style regression equation on students' mathematical problem solving ability tests is not significant. Thus, it can be concluded that the coefficient of the regression equation between VAK learning styles and students' mathematical problem solving ability tests is not significant in auditory and kinesthetic learning styles, but significant in visual learning styles.

Linearity Regression Test

Table 2. Test Results Linearity of Regression Equations Between Visual Learning Styles and Against Student Mathematical Problem Solving Ability Test

ANOVA Table

			Mean Square	F	Sig.
TKPM * Visual	Between Groups	(Combined)	63,848	1,223	, 267
		Linearity	419,315	8,035	, 006
		Deviation from Linearity	41,631	, 798	, 684
	Within Groups	52,189			
Total					

Based on Table 2. shows that the results of the linearity test between visual learning styles with the test of students' mathematical problem solving abilities obtained Sig. amounted to 0.684. Because the value of Sig. greater than 0.05 ($0.684 > 0.05$), then H_0 is accepted. So it can be concluded that the linear regression line of visual learning style with the students' mathematical problem solving ability test is linear.

Table 3. Test Results Linearity of Regression Equations Between Auditory Learning Styles and Against Student Mathematical Problem Solving Ability Test

ANOVA Table

			Mean Square	F	Sig.
TKPM * Auditory	Between Groups	(Combined)	76,227	1,530	, 110
		Linearity	47,771	, 959	, 331
		Deviation from Linearity	78,124	1,568	, 102
	Within Groups	49,830			
Total					

Based on Table 3. shows that the results of the linearity test between auditory learning styles with tests of students' mathematical problem solving abilities obtained Sig. amounted to 0.102. Because the value of Sig. greater than 0.05 ($0.102 > 0.05$), then H_0 is accepted. So it can be concluded that the linear regression line of auditory learning style with the students' mathematical problem solving ability test is linear.

Table 4. Test Results Linearity of Regression Equations Between Kinesthetic Learning Styles and Against Student Mathematical Problem Solving Ability Test

ANOVA Table

			Mean Square	F	Sig.
TKPM * Kinesthetic	Between Groups	(Combined)	54,033	, 994	, 477
		Linearity	104,925	1,931	, 169
		Deviation from Linearity	51,206	, 942	, 532
	Within Groups	54,336			
Total					

Based on Table 4. shows that the results of the linearity test between kinesthetic learning styles with tests of students' mathematical problem solving abilities obtained Sig. amounted to 0.532. Because the value of Sig. greater than 0.05 ($0.532 > 0.05$), then H_0 is accepted. So it can be concluded that the linear regression line of kinesthetic learning style with the test of students' mathematical problem solving ability is linear.

Thus, based on the three statements above, it can be concluded that the linear regression equation of VAK learning style with students' mathematical problem-solving ability tests is linear.

Model of Multiple Linear Regression Test Estimation

Table 5. Statistical Models Multiple Linear Regression Between Learning VAK Against Style Student Mathematical Problem Solving Ability Test

Model	Coefficients ^a		Standardized Coefficients Beta	t	Sig.
	Unstandardized Coefficients B	Std. Error			
1 (Constant)	63,831	8,239		7,748	,000
Visual	,589	,237	,277	2,482	,015
Auditory	-,043	,238	-,022	-,181	,857
Kinesthetic	,063	,215	,037	,291	,772

Based on Table 5. shows that the statistical model of multiple linear regression equations to estimate the effect of VAK learning styles on tests of mathematical problem solving abilities is as follows.

$$\hat{Y} = 63,831 + 0,589X_1 - 0,043X_2 + 0,063X_3$$

Table 6. Test Results Multiple Linear Regression Between Learning VAK Against Style Student Mathematical Problem Solving Ability Test

Model	ANOVA ^a					
		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	423,792	3	141,264	2,746	,047b
	Residual	4732,384	92	51,439		
	Total	5156,176	95			

Based on Table 6. obtained that the value of $F_{count} = 2.746$ and the value of $F_{table} = F_{\{(1-0.05)(92.3)\}} = 2.70$. Then it can be seen that the value of $F_{count} > F_{table}$, so that the hypothesis testing rejects H_0 and accepts H_1 . Thus it can be concluded that there is an influence of VAK learning styles (Visual, Auditory, Kinesthetic) on students' mathematical problem solving abilities.

4. CONCLUSION

Based on the results of the analysis, learning mathematics with VAK learning styles (Visual, Auditory, Kinesthetic) have an influence to students' mathematical problem solving abilities e-learning based. Based on the objectives, research results, and discussion as previously stated, conclusions related to learning styles, problem-solving abilities and e-learning learning were obtained, so conclusions were obtained. can influence VAK learning styles (Visual, Auditory, Kinesthetic) on students' mathematical problem solving abilities of $F_{count} = 2.746$ greater than $Table = 2.70$. In this research VAK learning styles (Visual, Auditory, Kinesthetic) are influential on students' mathematical problem solving abilities in SMP Negeri 1 Binjai, with contribution significant from each of them VAK learning styles (Visual, Auditory, Kinesthetic) that is as a whole by 8.2%, visual learning styles by 8.1%, auditory learning styles by 0.9%, and kinesthetic learning styles by 2.1%.

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